IEC Medium Voltage Switchgear
Type Power Xpert® UX
Presentation Contents

- Applications
- Eaton’s Core Technologies
- Power Xpert® UX Range
Power Xpert® UX
Safe, Reliable and Efficient Switchgear for all Indoor Medium Voltage Applications
Applications

Medium Voltage Switchgear
and Controlgear
Primary/Secondary Switchgear
& Motor Control

In
Mining
Utility Networks
Marine Systems
Process Industries
Commercial Construction
Pharmaceutical Industries
Water & Waste Water Treatment
Infrastructure Construction Projects
IEC Standards

Power Xpert® UX and W-VACi comply with all relevant IEC standards and are third party tested and certified

IEC 62271-1  Common specifications
IEC 62271-200  Metal-enclosed switchgear
IEC 62271-100  Circuit-breakers
IEC 62271-102  Earth switch
IEC 60265-1  Switch disconnectors
IEC 60470  Contactors
Medium Voltage Switchgear is in our DNA

Eaton has over 80 years experience in the design and manufacturing of MV Switchgear
Eaton is a Fully Integrated Manufacturer

Eaton is one of the few global fully integrated manufacturers of Medium Voltage equipment

- Vacuum Interrupter
- Encapsulated Pole Unit
- Circuit Breakers
- Switchgear
- Protection & Control

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Core technologies – Vacuum Switching

- Vacuum technology
  - Safe
  - Reliable
  - Compact Design
  - Maintenance Free
  - > 30,000 Operations
  - Typical Switching Duty of 100 x Isc
  - Environmentally Friendly
  - Fully Recycled at End of Life
Core technologies – Cast-resin Insulation

- Cast-resin Insulation
  - High Mechanical Strength
  - Protects Against Harsh Climatic Conditions
  - Protects Against Mechanical Impact Shock and Vibration
  - High Thermal Conductivity
  - High Electrical Resistivity and Creepage
  - Environmentally Friendly
Power Xpert® UX
A global design for IEC MV withdrawable switchgear

Power Xpert® UX12 – 12kV rated
Power Xpert® UX17 – 17.5kV rated
Power Xpert® UX24 – 24kV rated

An Eaton Green Solution
Basic Design

- Loss of Service Continuity
  - LSC2B
- Partition Class
  - PM
- Internal Arc Classification
  - AFLR
  (Operator, Front, Lateral, Rear)
Basic Design

- Accessibility of Compartments
  - Cable:
    - Interlocked Controlled / Procedure
  - Circuit Breaker:
    - Interlocked Controlled
  - Busbars:
    - Non-Accessible / Tool Based

- Ingress Protection
  - External IP4X (IP41 option)
  - Internal IP2X (IP3X option)
Detailed Design

1. Arc Chamber
2. Low-voltage Wire-way
3. Low-voltage Compartment
4. Busbar Compartment
5. Circuit Breaker Compartment
6. Automatic Shutters
7. Earth Switch
8. Current Transformers
9. Voltage Transformers
10. Cable Terminations
11. Earth Bar
Arc Chamber

- Internal Arc Classification – AFLR
  - Power Xpert® UX has IAC ratings of
    - 12kV & 17.5kV ratings:
      - 25kA-1s; 31.5kA-1s; 40kA-1s & 50kA-0.5s
    - 24kV ratings:
      - 25kA-1s
  - Arc pressures and flames are directed away from personnel by an integral Arc Chamber with optional extension pieces, wall flanges and grille to exhaust outside the switch-room.
3 Basic Design – Low-Voltage Compartment

1. Low-voltage Compartment
2. Protection Relay
3. Mimic Diagram
4. Instruments
5. Voltage Detection System (VDS)
6. Breaker Position
7. Breaker Status
8. Earth Switch

Low-voltage wire-way

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Eaton’s range of Protection Relays are standard

All other manufacturer’s relays and Bay Controllers can be fitted.
Eaton’s range of Protection Relays are standard
All other manufacturer’s relays and Bay Controllers can be fitted.
Low-Voltage Compartment

3 Clear to understand silk screen mimic diagram of each circuit

4 Ammeter and Voltmeter with or without phase selector switches are possible

5 Voltage Detection System (VDS) is driven from capacitor dividers mounted in bushings attached to the cable
Low-Voltage Compartment

- Position / Status Indicators can be LED, Semaphore or Indicator Lamp type
- Contacts in the carriage of the circuit breaker and contactor provide facility for:
  - Breaker ‘Connected/Test – Disconnected’ position indicator
  - Breaker ‘Open/Closed’ status indicator
  - Earth switch ‘Open/Closed’ status indicator
Busbar Compartment

- Totally enclosed in earthed metal compartment which vents directly into the integral arc chamber.
- Fully insulated over entire length
- Epoxy mouldings segregate individual switchgear sections
4 Busbar Compartment

- 12kV and 17.5kV
  - Up to 4000A fan cooled, 3150A natural cooling.
  - 3 second Short Circuit ratings of: 25kA, 26.3kA, 31.5kA, 40kA & 50kA
- 24kV
  - Up to 2500A
  - 3 second Short Circuit rating of: 20kA and 25kA
Vacuum Circuit Breaker Compartment

The Heart of the System:

1. Eaton’s new range of Vacuum Circuit Breakers. The W-VACi

2. Eaton’s range of Vacuum Contactors. The SL
5 Vacuum Circuit Breaker Compartment

9 Viewing Window

10 Manual Circuit Breaker Operation

11 Circuit Breaker Racking Mechanism
Vacuum Circuit Breaker Compartment

9. Viewing window provides visual indication of the position of the circuit breaker / contactor truck.


11. Manual circuit breaker / contactor truck racking mechanism
Vacuum Circuit Breaker Compartment

Safety Interlocks

• Compartment door is mechanically interlocked with the circuit breaker / contactor truck such that the door can ONLY be opened with the truck is in the ‘Test – Disconnected’ position.
• Breaker Secondary contact interlocked with the breaker and can only be removed in the Test position
W-VACi Vacuum Circuit Breaker
12kV, 17.5kV, 24kV

- Industry leading vacuum and cast-resin insulation technology
- Conformance to latest IEC
  - Designed and tested to latest IEC62271-100 standard
- Environmentally friendly design
  - Vacuum technology
  - ROHS compliance
**W-VACi Innovation and Reliability**

- **World Leading Vacuum Interrupters**
  Eaton has over 40 years of knowledge and understanding in the development and application of Vacuum Interrupter Technology in MV Switchgear.

- **Epoxy Encapsulation Technology**
  Eaton has over 50 years of knowledge and understanding in the development and application of Epoxy Insulation Technology in MV Switchgear.

- **Universal Mechanism Assembly**
  Eaton has over 80 years of knowledge and understanding in the development and application of mechanisms for the control of circuit breakers MV Switchgear.

- **W-VACi Vacuum Circuit Breaker**
  Eaton’s latest design of MV Vacuum Circuit Breaker draws on all the knowledge and understanding gained though more than 80 years of experience in MV Switchgear.

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W-VAC® Vacuum Circuit Breaker Family

3 Frame sizes cover all ratings

<table>
<thead>
<tr>
<th>Frame 1</th>
<th>Frame 2</th>
<th>Frame 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>150mm Pole Spacing</td>
<td>210mm Pole Spacing</td>
<td>275mm Pole Spacing</td>
</tr>
<tr>
<td>12kV ≤ 1250A</td>
<td>12kV ≤ 2000A</td>
<td>12kV ≤ 4000A</td>
</tr>
<tr>
<td>17.5kV ≤ 1250A</td>
<td>17.5kV ≤ 2000A</td>
<td>17.5kV ≤ 4000A</td>
</tr>
<tr>
<td></td>
<td>24kV ≤ 1250A</td>
<td>24kV ≤ 2500A</td>
</tr>
</tbody>
</table>
W-VAC/i Vacuum Circuit Breaker Family

Frame 1: 150mm Pole Spacing – 2 Pole Heights: 12kV and 17.5kV – 630A and 1250A

Frame 1
205 mm height between line and load
12kV = 630A
17.5kV = 630A

Frame 1
275 mm height between line and load
12kV = 1250A
17.5kV = 1250A
W-VACi Vacuum Circuit Breaker Family

**Frame 2**
- 275 mm height between line and load
- 12kV ≤ 2000A
- 17.5kV ≤ 2000A
- 24kV ≤ 1250A

**Frame 3**
- 310 mm height between line and load
- 12kV ≤ 4000A
- 17.5kV ≤ 4000A
- 24kV ≤ 2500A
### W-VACi Vacuum Circuit Breaker Ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>IEC 62 271-100</th>
<th>Unit</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Designation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Voltage</td>
<td></td>
<td>kV</td>
<td>12</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td></td>
<td>Hz</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated Insulation Level</td>
<td>Rated Power Frequency Withstand Voltage / 1 minute</td>
<td>kV</td>
<td>28</td>
</tr>
<tr>
<td>Lightning Impulse Withstand Voltage (peak value)</td>
<td></td>
<td>kV</td>
<td>75</td>
</tr>
<tr>
<td>Rated Normal Current</td>
<td>A</td>
<td></td>
<td>630/1250/2000/2500/3150/4000*</td>
</tr>
<tr>
<td>Rated Peak Withstand Current</td>
<td>kA/50Hz</td>
<td></td>
<td>66/80/100/125</td>
</tr>
<tr>
<td>Rated Short-time Withstand Current</td>
<td>kA</td>
<td></td>
<td>25/26.3/31.5/40/ 50</td>
</tr>
<tr>
<td>Rated duration of short circuit</td>
<td>s</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Rated Short Circuit Breaking Current</td>
<td>kA</td>
<td></td>
<td>25/26.3/31.5/40/50</td>
</tr>
<tr>
<td>Rated Short Circuit Making Current (peak value)</td>
<td>kA</td>
<td></td>
<td>65/66/82/104/130</td>
</tr>
<tr>
<td>Electrical Endurance</td>
<td>Operations</td>
<td>E2, Class S1, cable connection</td>
<td>E2, Class S1, cable connection</td>
</tr>
<tr>
<td>Mechanical Endurance</td>
<td>Operations</td>
<td>M2 (20,000)</td>
<td>M2 (20,000)</td>
</tr>
<tr>
<td>Operating Sequence</td>
<td>O-0.3s-CO-15s-CO</td>
<td></td>
<td>O-0.3s-CO-15s-CO</td>
</tr>
<tr>
<td>Auxiliary Control Voltage</td>
<td>V</td>
<td></td>
<td>110/120/127VAC 50/60Hz, 208/220/240VAC 50/60Hz, 24/48/60VDC, 110/125VDC, 220/250VDC</td>
</tr>
<tr>
<td>Capacitive Switching (single bank)</td>
<td>C2 (400A rating only) [1]</td>
<td></td>
<td>C2 (400A rating only) [1]</td>
</tr>
<tr>
<td>Capacitive Switching (multiple bank back to back)</td>
<td>C1 (400A rating only) [1]</td>
<td></td>
<td>C1 (400A rating only) [1]</td>
</tr>
<tr>
<td>Cable Charging</td>
<td>C2 (25A)</td>
<td></td>
<td>C2 (31.5A)</td>
</tr>
<tr>
<td>Auxiliary Contacts</td>
<td>5A/5B, with optional 10A/10B</td>
<td></td>
<td>5A/5B, with optional 10A/10B</td>
</tr>
<tr>
<td>Auxiliary Contact Rating</td>
<td>A</td>
<td></td>
<td>10 AC / 2 DC</td>
</tr>
</tbody>
</table>

[1] = 630 A breaker only. No Back to Back Capacitor Switching for other ratings.

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Motor Control Applications

- Rated Voltage: 7.2kV
  - 400A (250A with fuse installed)
  - Easy fuse replacement
  - Fuse blown indication option
- Withdrawable carriage consistent with W-VACi
  - Same interlocks
  - Same position indicators
  - Same racking mechanism
Automatic Shutters

- Individually operated
- Earthed Metal
- Can be padlocked in closed position
- Colour coding & Text option
- Shutter lifter option available for testing purposes
Circuit Earth Switch

- Operated from front of switchgear
- ‘Closed/Open’ status visible from front cable chamber window.
- Status indication available on the low-voltage compartment mimic
- Mechanical interlock option with the cable compartment door
Circuit Earth Switch (if required)

Mechanical interlock with the circuit breaker compartment such that:

- Earth Switch cannot be ‘Closed’ with the circuit breaker / contactor in the ‘Service’ position.
- Circuit breaker / contactor can only be moved from ‘Test – Disconnected’ to ‘Service’ position when Earth Switch is ‘Open’.
Current Transformers

- Cast-resin, block-type CTs are offered as standard
- Up to 4 CTs per phase may be possible depending on rating
- Option for wire-wound CTs is available
- Ratings > 2500A are Cast-resin, ring-type
• Fixed (demountable) circuit voltage transformers.
• Withdrawable primary fuses provide isolation
• Option for withdrawable truck mounted busbar voltage transformers mounted in separate panel.
Cable Terminations

• Bottom cable entry is standard, option for Top cable entry possible
• Front and/or Rear cable access
• Depending on rating and cable size up to 9 single core cables per phase possible
Cable Terminations

- Easy Front cabling access:
  1. Remove breaker/contactor
  2. Remove mid-pan
  3. Remove voltage transformers
  4. Full access now available
Earth Bar

- Fault tested earth bar system
- Effective and easy connection to the station earth
- Runs vertically and horizontally in each section and connected to Earth Switches when provided
Panel Configurations
Truck Configurations

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Panel Configurations
Electrical Ratings & Dimensions

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Power Xpert® UX 12 – 17.5kV

Technical data

<table>
<thead>
<tr>
<th></th>
<th>kV</th>
<th>12 &amp; 17.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar rated current</td>
<td>A</td>
<td>1250, 2000, 3150/(4000FC)</td>
</tr>
<tr>
<td>Short time current</td>
<td>kA-3s</td>
<td>25, 26.3, 31.5, 40, 50</td>
</tr>
<tr>
<td>IAC</td>
<td>kA-s</td>
<td>25-1, 31.5kA-1, 40-1, 50-0.5</td>
</tr>
</tbody>
</table>

Circuit-Breakers:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>630, 1250, 2000, 3150, 4000FC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current max</td>
<td>630, 1250, 2000, 3150, 4000FC</td>
<td></td>
</tr>
<tr>
<td>Short time current</td>
<td>25, 31.5, 40, 50</td>
<td></td>
</tr>
</tbody>
</table>

| Panel width                    | mm       | 600, 800, 1000                 |
| Panel height                   | mm       | 2200 / 2760*                  |

* Height over the arc chamber
# Power Xpert® UX 24kV

## Technical data

<table>
<thead>
<tr>
<th></th>
<th>kV</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar rated current</td>
<td>A</td>
<td>1250, 2500</td>
</tr>
<tr>
<td>Short time current kA-3s</td>
<td>20, 25</td>
<td></td>
</tr>
<tr>
<td>IAC kA-1s</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit-Breakers,</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current max A</td>
<td>800, 1250, 2000, 2500</td>
<td></td>
</tr>
<tr>
<td>Short time current kA-3s</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

| Panel width | mm | 800, 1000 |
| Panel height| mm | 2200 / 2760 |

* Height over the arc chamber
## Dimensions & Weights

<table>
<thead>
<tr>
<th>Panel width</th>
<th>600 mm</th>
<th>800 mm</th>
<th>1000 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 kV and 17.5 kV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. rating</td>
<td>630 A / 1250 A</td>
<td>2000 A</td>
<td>3150 A / 4000 A (FC)</td>
</tr>
<tr>
<td>Depth</td>
<td>1320</td>
<td>1320 / 1500*</td>
<td>1500</td>
</tr>
<tr>
<td>Height (A)</td>
<td>2200</td>
<td>2200</td>
<td>2200</td>
</tr>
<tr>
<td>Height including Arc Chamber (B)</td>
<td>2750</td>
<td>2750</td>
<td>2750</td>
</tr>
<tr>
<td>Weight (in kg)</td>
<td>880</td>
<td>1230</td>
<td>1670</td>
</tr>
<tr>
<td><strong>24 kV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. rating</td>
<td>800 A / 1250 A</td>
<td>2000 A / 2500 A</td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>1550</td>
<td>1550</td>
<td></td>
</tr>
<tr>
<td>Height (A)</td>
<td>2320</td>
<td>2320</td>
<td></td>
</tr>
<tr>
<td>Height including Arc Chamber (B)</td>
<td>2870</td>
<td>2870</td>
<td></td>
</tr>
<tr>
<td>Weight (in kg)</td>
<td>1480</td>
<td>1830</td>
<td></td>
</tr>
</tbody>
</table>

*) 1500 mm for IAC classification ratings of 40 kA-1s and 50 kA-0.5s only